A Summary of the 2004 TMDL Monitoring for Selected Pesticides in the Northern San Joaquin Basin, California

March - August 2004

Henry J. Calanchini

Michael L. Johnson

John Muir Institute of the Environment

University of California, Davis

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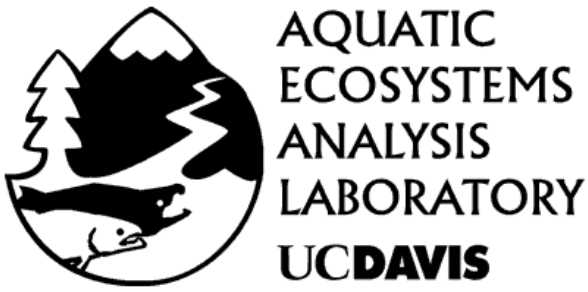

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Introduction

This report describes the results of pesticide monitoring at five locations in four waterways of California's southern Central Valley associated with irrigation runoff that occurred during the months of March, July and August of 2004. The river loading rates of diazinon and chlorpyrifos were also calculated for each sampling event. Monitoring was conducted by staff of the Aquatic Ecosystems Analysis Laboratory (AEAL) of the John Muir Institute of the Environment, University of California, Davis, as authorized under Contract No. 02-210-150 from the Central Valley Regional Water Quality Control Board (CVRWQCB).

Objective

The primary objective of this project was to monitor five sites in the northern San Joaquin River basin during the 2004 irrigation season to characterize the sources of diazinon, chlorpyrifos and other pesticides that can cause surface water contamination and toxic conditions to aquatic life. The results of this study will be used to support the development of diazinon and chlorpyrifos TMDLs in the northern San Joaquin basin.

Monitoring Overview

Five sites (Figure 1, Table 1) were monitored a total of ten times each on the following dates: 10, 17, 25 and 31 March; 9, 15 and 29 July; 4, 20 and 25 August 2004. No sampling was conducted during the months April through June, because previous monitoring results, and the California Department of Pesticide Regulation pesticide use records, indicate that relatively little diazinon and chlorpyrifos are applied to crops in the northern San Joaquin Basin during these months.

The measured field parameters included pH, water temperature and electrical conductivity (EC). Discharge measurements for selected sites were obtained from U.S. Geological Survey (USGS) and California Department of Water Resources (DWR) data (Table 2) available on the internet. Water samples were delivered to the California Department of Food and Agriculture (CDFA) laboratory in Sacramento, California for chemical analysis using gas chromatography (GC) and mass spectrometry (MS).

The CDFA laboratory analyzed 17 chemical compounds for each water sample. The list of compounds is provided in Table 3. The detection frequencies, concentrations and calculated instantaneous loading rates for diazinon and chlorpyrifos are presented in Table 4. The detection frequencies and concentrations of the other 15 compounds are listed in Appendix A. The analytical results for all tested compounds, and the physical parameters measured in the field are presented in tabular format on a compact disc appended to this report.

Figure 1. The five sampling sites in the San Joaquin Basin monitored for pesticides during the irrigation season 2004.

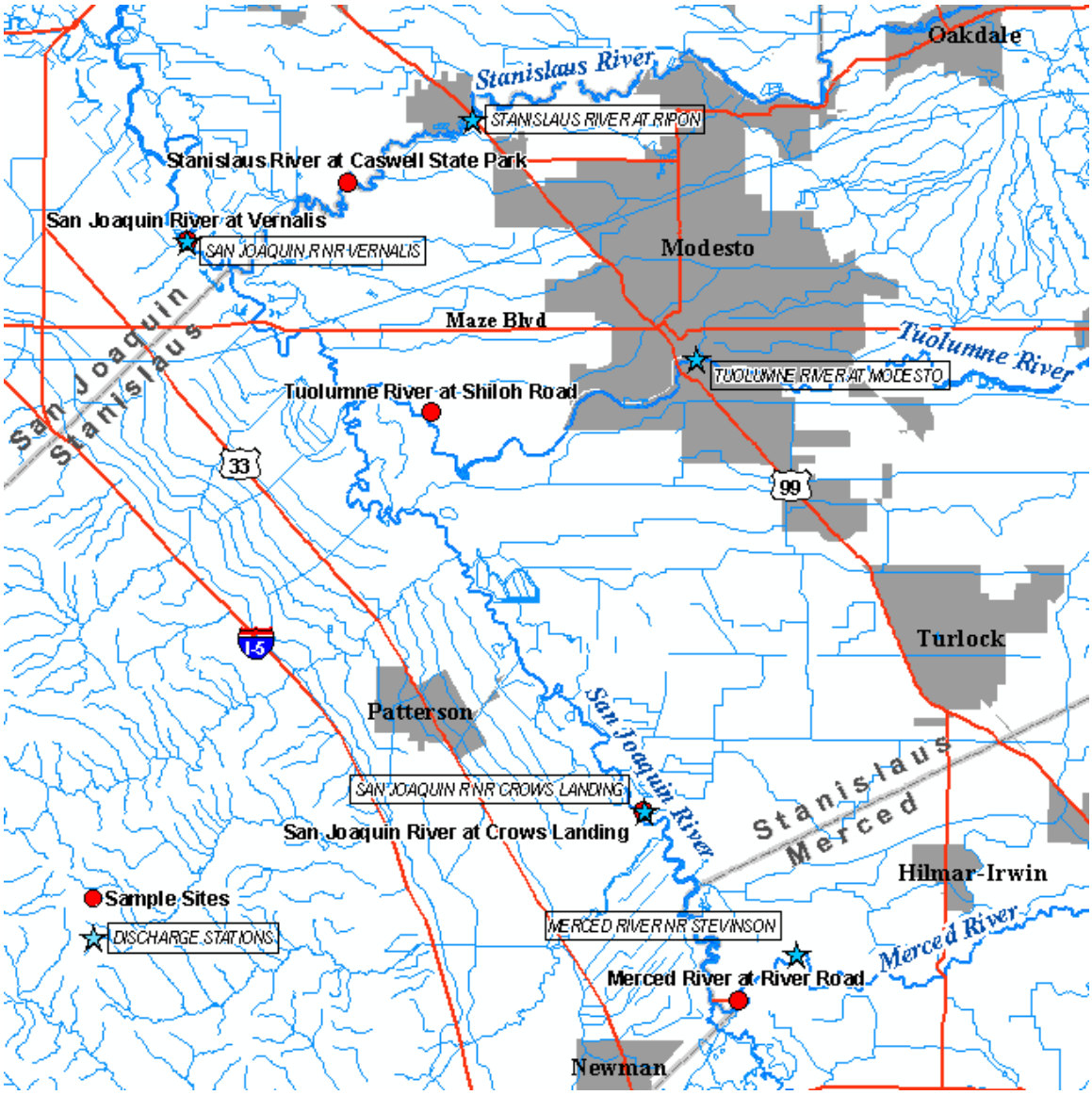

Table 1. Sample sites, collection methods and sampling dates

Site #	Site Name	Sample collection Method	Sampling Dates
1	Merced River at River Road	Integrated grab from bridge	March 10, 17, 25, 31, 2004 July 9, 15, 29, 2004 August 4, 20, 25, 2004
3	San Joaquin River at Crows Landing	Grab from pier	March 10, 17, 25, 31, 2004 July 9, 15, 29, 2004 August 4, 20, 25, 2004
5	Tuolumne River at Shiloh Road	Integrated grab from bridge	March 10, 17, 25, 31, 2004 July 9, 15, 29, 2004 August 4, 20, 25, 2004
6	San Joaquin River at Vernalis	Integrated grab from bridge	March 10, 17, 25, 31, 2004 July 9, 15, 29, 2004 August 4, 20, 25, 2004
7	Stanislaus River at Caswell State Park	Grab from bank	March 10, 17, 25, 31, 2004 July 9, 15, 29, 2004 August 4, 20, 25, 2004

Sample Collection Methods

All samples were collected by either grab or integrated grab methods (Table 1). Grab samples were collected by harnessing a 1-liter amber glass bottle to a pole sampler and dipping the bottle into the stream as close to the center of the channel as possible.

Integrated grab samples were collected by lowering a 3-liter PTFE (polytetrafluoroethylene) bottle, strapped in a weighted cage, from a bridge at three equally spaced verticals. At each vertical the bottle was filled approximately ¼ full. The composite sample was then thoroughly agitated and poured into a 1-liter amber glass sample bottle.

Discharge Sources, Methods and Stream Drainage Characteristics

Discharge estimates were obtained from USGS and DWR gages listed on the California Data Exchange Center (CDEC) http://cdec.water.ca.gov/ website. At sites where discharge gages were not present, discharge values from the nearest gage on the same stream were used. An explanation of the discharge source and characteristics of the stream drainage are listed below for each site.

Merced River at River Road – Data for this site were obtained from the CDEC gage MST (Merced River at Stevinson) located approximately 3.68 miles upstream. The gage elevation is 59 feet and the sample site elevation is 53 feet. The low gradient (6 feet over 3.68 miles) and the size of the river allowed us to make the assumption that the river

rises fairly uniformly under normal conditions, therefore, flow data from the MST gage were used unadjusted. There is one semi-permanent stream between the sample site and the discharge gage. Flows are unknown for this stream and were assumed to be negligible. The river flows through an urban area near Livingston about 20 miles upstream from the sample site.

San Joaquin River at Crow's Landing – USGS gage 11274550 is located at the sampling site. Mark Woloszyk of USGS provided hourly discharge data that was not available on the internet. The Crow's Landing site is located between the major inputs of the Merced River to the south and the Tuolumne River to the north.

Tuolumne River at Shiloh Road **-** The CDEC gage MOD (Tuolumne River at Modesto) was used to obtain discharge measurements for the sampling site. There are no other suitable gages for making any kind of distance-weighted hydrograph, so the data were used as presented on the CDEC website. There are significant urban areas upstream, including Modesto and Waterford. Since we did not measure discharge at this site, and no other measures were taken to determine the applicability of the MOD discharge data, we cannot draw any conclusions about the accuracy of the discharge estimates.

San Joaquin River at Vernalis – USGS and DWR jointly operated discharge station 11303500 (San Joaquin River near Vernalis) was used for this site. The sampling site and gage are both located at the Durham Ferry highway bridge. Data were used unadjusted from the CDEC website. This location is approximately 2.6 miles downstream of the confluence with the Stanislaus River. The drainage area is approximately 13,536 mi^2 and also incorporates the flows of the Merced and Tuolumne rivers, Orestimba Creek, Del Puerto Creek, Dry Creek and Salt Slough.

Stanislaus River at Caswell State Park - Discharge was obtained from USGS gage 11303000 on the Stanislaus River near Ripon, approximately eight miles upstream of the sampling site. The CDEC data were used unadjusted from the Ripon station. The river flows through an urban area at Ripon and through several urban areas upstream of Ripon.

Table 2. Sampling Sites Discharge Sources

Site Discharge Information							
Site #	**Site Name**	**USGS ID #**	**CDEC ID #**	**Agency**	**Type**	**Lat**	**Long**
1	Merced River at River Road	---	MST	DWR	Hourly	37°22'16"	120°55'52"
3	San Joaquin River at Crows Landing	11274550	SCL	USGS	Hourly	37°25'55"	121°00'46"
5	Tuolumne River at Shiloh Road	11290000	MOD	USGS/DWR	Hourly	37°37'38"	120°59'11"
6	San Joaquin River at Vernalis	11303500	VNS	USGS	Hourly	37°40'01"	121°16'01"
7	Stanislaus River at Caswell State Park	11303000	RIP	USGS	Hourly	37°43'48"	121°06'32"

Loading Rate Calculations

Instantaneous loading rates of diazinon and chlorpyrifos were calculated by multiplying the stream discharge at the time of sample collection by the measured concentrations of each pesticide by the number of seconds (86,400) in one day. Loading rates were only calculated when the pesticide concentration was above the limit of detection and a discharge estimate was available. For all samples where pesticide concentrations were below the limit of detection, the loading rate was assumed to be zero.

The highest and lowest calculated instantaneous loading rates for diazinon were in the San Joaquin River at Vernalis and the Tuolumne River at River Road, respectively. The highest and lowest calculated instantaneous loading rates for chlorpyrifos were in the San Joaquin River at Crows Landing and Merced River at River Road, respectively.

Laboratory Analysis Methods

Upon arrival at the CDFA laboratory, the environmental samples were weighed then spiked with 500µL of 1.0 µg/ml chlorpyrifos methyl (0.5µg/mL) surrogate spiking solution. Each sample was emptied into a 2-liter separatory funnel and approximately 10-15g of granular sodium chloride was added. Sixty ml of methylene chloride were added and the sample was then mixed for three minutes. The organic fraction was filtered through a bed of granular anhydrous sodium sulfate (approx. 20g). The extraction process was repeated three times and the resultant sample was evaporated to 5-7 ml at 40° C, then evaporated to dryness with an N-evaporator. One ml of methylene chloride and 10µL of a 5.0µg/mL internal standard solution were added to each sample. Samples were stored in a –5ºC freezer until analysis. Samples were analyzed with an Agilent

Model 5973 GC-MSD using a HP-5MS or equivalent GC column. Analysis was performed in the selective ion-monitoring mode.

Each samples was analyzed for seventeen compounds. The compounds and their respective limits of quantitation (LOQ) and limits of detection (LOD) are listed in Table 3. The lab reported estimated values when the values were below the LOQ but above the LOD. To ensure the accuracy and precision of the sample analysis, lab spikes, blanks, and a surrogate standard (chlorpyrifos methyl) were used. If the recovery of a spike sample was out of the control range, the water sample was re-analyzed.

Table 3. CDFA Laboratory limits of detection and practical quantitation limits for select pesticides

Compound	Limit of Detection (LOD in µg/L)	Limit of Quantitation (LOQ in µg/L)
Azinphos methyl	0.007	0.050
Bifenthrin	0.007	0.050
Carbaryl	0.007	0.020
Chlorpyrifos	0.004	0.010
Cyanazine	0.007	0.050
Cyfluthrins	0.070	0.200
Cypermethrins	0.070	0.200
Dacthal (DCPA)	0.007	0.050
Diazinon	0.007	0.020
Disulfoton	0.007	0.020
EPTC (Eptam)	0.020	0.050
Esfenvalerate	0.007	0.050
l-Cyhalothrin	0.030	0.100
Methidathion	0.010	0.030
Metolachlor	0.007	0.020
Propargite	0.150	0.500
Simazine	0.005	0.200

Quality Assurance Objectives

Sampling during the 2004 irrigation season was conducted under the guidance of a draft Quality Assurance Project Plan (QAPP) (San Joaquin River TMDL Quality Assurance Project Plan. Azimi-Gaylon and Reyes, 2002). The draft QAPP stated the Quality Assurance Objective (QAO) for precision was a relative percent difference (RPD) of less than 50%. No QAO was stated for accuracy. Accuracy is measured by determining the percent recovery of known concentrations of analytes spiked into

environmental samples or reagent water before extraction. A 70-130% recovery rate is commonly viewed as acceptable (D. McClure, pers. comm.) and, for the purpose of this report, will be used as the QAO for accuracy in laboratory analytical measurements. When reporting analytical results it is customary to flag those results that fall outside of the acceptable level of recovery as stated in the QAOs. For the purpose of this report all results outside of the 70-130% recovery range will be flagged as follows: B = possibly biased high due to high surrogate recovery in sample; only three samples had surrogate recoveries outside of the acceptance limits and all were high (132%-140%).

Results

A total of 50 environmental samples (Table 4) and 19 quality control (QC) samples (Table 5) were collected and analyzed.

Environmental samples

Concentrations of diazinon and chlorpyrifos ranged from below detection to 0.028 parts per billion (ppb) of diazinon and 0.027 ppb chlorpyrifos in the Tuolumne River at Shiloh Road on 25 August and 9 July 2004, respectively (Table 4).

Other pesticides detected in the environmental samples were EPTC (Eptam), Simazine, Carbaryl, Metolachlor and Propargite (Table 4).

Quality Control Samples

Sample quality control was measured through collection of sequential duplicates (n=10) and field blanks (n=9). No matrix spikes were collected. Duplicate samples provided a measure of analytical precision; field blanks were used to evaluate possible introduction of contaminants during sample collection, handling and transport to the lab. The procedures used for collecting the QA/QC samples were based on the San Joaquin River TMDL Quality Assurance Project Plan (Azimi-Gaylon and Reyes, 2002).

The relative percent difference (RPD) between environmental and duplicate sample concentrations of chlorpyrifos ranged from 10.53 - 40% (Table 5). There were six detections of diazinon in the environmental samples and none in any of the duplicate samples (Table 5). Two samples that were scheduled as field blanks were accidentally collected as duplicates. These samples are listed as duplicates in Table 5 and are identified with a footnote.

No analytes were detected in the field blanks. A summary of the environmental data is presented in Table 4.

Table 4. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and instantaneous loading rates for sites in the San Joaquin River Basin, California. March, July and August 2004.

Stream flow is in cubic feet per second. J: the reported concentrations were below the quantitative limit and are considered estimates; B: possibly biased high due to high surrogate recovery in sample; NA: not available; ND: Not detected; g a.i./d: grams active ingredient per day; µg/L: microgram per liter.

Site number	Site name	Site identification number	Date (month/day/year)	Time (24 hr)	Stream flow (cfs)	Chlorpyrifos concentration (µg/L)	Chlorpyrifos instantaneous loading rate (g a.i./d)	Diazinon concentration (µg/L)	Diazinon instantaneous loading rate (g a.i./d)
1	Merced R @ River Rd	11273500	3/10/2004	12:30	274	<0.004	NA	<0.007	NA
			3/17/2004	11:00	234	<0.004	NA	<0.007	NA
			3/25/2004	11:50	252	<0.004	NA	<0.007	NA
			3/31/2004	11:20	260	<0.004	NA	<0.007	NA
			7/9/2004	10:30	60	(0.008 J)	1.17	<0.007	NA
			7/15/2004	12:30	96	(0.008 J)	1.88	<0.007	NA
			7/29/2004	12:20	NA	0.024	NA	<0.007	NA
			8/4/2004	8:40	NA	<0.004	NA	<0.007	NA
			8/20/2004	9:40	128	(0.010 J)	3.13	<0.007	NA
			8/25/2004	9:30	93	<0.004	NA	<0.007	NA
3	San Joaquin River at Crow's Landing	11274550	3/10/2004	12:00	1510	0.026	96.05	<0.007	NA
			3/17/2004	10:20	1110	0.014	38.02	<0.007	NA
			3/25/2004	11:20	984	<0.004	NA	<0.007	NA
			3/31/2004	11:00	911	(0.007 J)	15.60	<0.007	NA
			7/9/2004	10:10	439	(0.009 J)	9.67	<0.007	NA
			7/15/2004	12:00	388	(0.005 J)	4.75	<0.007	NA
			7/29/2004	11:50	374	<0.004	NA	<0.007	NA
			8/4/2004	9:10	424	(0.006 J)	6.22	(0.014 J)	14.52
			8/20/2004	11:20	551	(0.009 J)	12.13	<0.007	NA
			8/25/2004	10:00	700	(0.005 J)	8.56	<0.007	NA
5	Tuolumne River at Shiloh Road	11290000	3/10/2004	11:00	1240	<0.004	NA	<0.007	NA
			3/17/2004	9:40	1410	<0.004	NA	<0.007	NA
			3/25/2004	10:40	1000	B 0.014	34.25	<0.007	NA
			3/31/2004	10:20	735	<0.004	NA	<0.007	NA
			7/9/2004	9:10	238	0.027	15.72	<0.007	NA
			7/15/2004	11:20	236	0.019	10.97	<0.007	NA

Table 4. Summary of environmental data collected on diazinon and chlorpyrifos concentrations and instantaneous loading rates for sites in the San Joaquin River Basin, California. March, July and August 2004.

Stream flow is in cubic feet per second. J: the reported concentrations were below the quantitative limit and are considered estimates; B: possibly biased high due to high surrogate recovery in sample; NA: not available; ND: Not detected; g a.i./d: grams active ingredient per day; µg/L: microgram per liter.

Site number	Site name	Site identification number	Date (month/day/year)	Time (24 hr)	Stream flow (cfs)	Chlorpyrifos concentration (µg/L)	Chlorpyrifos instantaneous loading rate (g a.i./d)	Diazinon concentration (µg/L)	Diazinon instantaneous loading rate (g a.i./d)
5	Tuolumne River at Shiloh Road	11290000	7/29/2004	11:10	245	(0.007 J)	4.20	(0.008 J)	4.80
	Continued		8/4/2004	9:50	242	0.012	7.10	(0.010 J)	5.92
			8/20/2004	12:20	210	<0.004	NA	(0.010 J)	5.14
			8/25/2004	10:40	225	<0.004	NA	0.028	15.41
6	San Joaquin River at Vernalis	11303500	3/10/2004	10:30	3190	0.012	93.65	<0.007	NA
			3/17/2004	9:10	2940	<0.004	NA	<0.007	NA
			3/25/2004	10:00	2900	B (0.005 J)	35.47	<0.007	NA
			3/31/2004	9:50	2410	(0.004 J)	23.58	<0.007	NA
			7/9/2004	8:40	1100	(0.006 J)	16.15	(0.014 J)	37.68
			7/15/2004	10:30	1100	(0.006 J)	16.15	<0.007	NA
			7/29/2004	10:30	1010	(0.010 J)	24.71	<0.007	NA
			8/4/2004	10:20	1140	<0.004	NA	<0.007	NA
			8/20/2004	10:20	1030	<0.004	NA	<0.007	NA
			8/25/2004	11:10	1270	<0.004	NA	<0.007	NA
7	Stanislaus River at Caswell S.P.	374209121103800	3/10/2004	10:00	270	<0.004	NA	<0.007	NA
			3/17/2004	8:30	306	<0.004	NA	<0.007	NA
			3/25/2004	9:20	343	<0.004	NA	<0.007	NA
			3/31/2004	9:10	417	<0.004	NA	<0.007	NA
			7/9/2004	7:50	570	(0.009 J)	12.55	<0.007	NA
			7/15/2004	9:50	495	(0.007 J)	8.48	<0.007	NA
			7/29/2004	10:00	435	(0.007 J)	7.45	<0.007	NA
			8/4/2004	10:50	409	0.014	14.01	<0.007	NA
			8/20/2004	13:20	346	<0.004	NA	<0.007	NA
			8/25/2004	11:50	369	<0.004	NA	<0.007	NA

Table 5. Summary of diazinon and chlorpyrifos concentrations quality-control data for sites in the San Joaquin River Basin, California, March, July and August 2004.

NA: not applicable - cannot be calculated because of "less than" concentration; µg/L: microgram per liter; J: the reported concentrations were below the quantitative limit and are considered estimates; <: less than

Site identification number	Site name	Date and time (month/day/year 24-hour time)	Chlorpyrifos (ug/L)	Relative percent difference OR percent recovery (chlorpyrifos)	Diazinon (ug/L)	Relative percent difference OR percent recovery (diazinon)
DUPLICATES						
11273500	Merced River at River Road	3/17/2004 11:00	<0.004		<0.007	
		3/17/2004 11:03	<0.004	NA	<0.007	NA
11273500	Merced River at River Road	8/4/2004 8:40	<0.004		<0.007	
		8/4/2004 8:43	(0.009 J)	NA	<0.007	NA
11273500	Merced River at River Road	8/25/2004 9:30	<0.004		<0.007	
		8/25/2004 9:33	<0.004	NA	<0.007	NA
11274550	San Joaquin River at Crow's Landing	3/31/2004 11:00	(0.007 J)		<0.007	
		3/31/2004 11:03	(0.008 J)	13.33%	<0.007	NA
11274550	San Joaquin River at Crow's Landing	8/20/2004 11:20	(0.009 J)		<0.007	
		8/20/2004 11:23	(0.008 J)	11.76%	<0.007	NA
11290200	Tuolumne River at Shiloh Road	7/15/2004 11:20	0.019		<0.007	
		7/15/2004 11:23	0.017	11.11%	<0.007	NA
11303500	San Joaquin River at Vernalis	3/10/2004 10:30	0.012		<0.007	
		3/10/2004 10:33	0.014	15.38%	<0.007	NA
11303500	San Joaquin River at Vernalis	7/29/2004 10:30	(0.010 J)		<0.007	
		7/29/2004 10:31	(0.009 J)[1]	10.53%	<0.007	NA
374209121103800	Stanislaus River at Caswell State Park	3/25/2004 9:20	<0.004		<0.007	
		3/25/2004 9:23	<0.004	NA	<0.007	NA
374209121103800	Stanislaus River at Caswell State Park	7/9/2004 7:50	(0.009 J)		<0.007	
		7/9/2004 7:51	(0.006 J)[1]	40.00%	<0.007	NA
BLANKS						
11274550	San Joaquin River at Crow's Landing	3/17/2004 10:21	<0.004		<0.007	
11274550	San Joaquin River at Crow's Landing	7/15/2004 12:01	<0.004		<0.007	
11274550	San Joaquin River at Crow's Landing	8/4/2004 9:11	<0.004		<0.007	
11290200	Tuolumne River at Shiloh Road	3/10/2004 11:01	<0.004		<0.007	
11290200	Tuolumne River at Shiloh Road	3/31/2004 10:21	<0.004		<0.007	
11290200	Tuolumne River at Shiloh Road	7/29/2004 11:11	<0.004		<0.007	
11290200	Tuolumne River at Shiloh Road	8/20/2004 12:11	<0.004		<0.007	
11303500	San Joaquin River at Vernalis	3/25/2004 10:01	<0.004		<0.007	
374209121103800	Stanislaus River at Caswell State Park	8/25/2004 11:51	<0.004		<0.007	

[1]Sample was scheduled as an environmental blank but accidentally collected as a sequential duplicate.

Sources Cited

Azimi-Gaylon, S., and E. Reyes. 2002. Quality Assurance Project Plan for Monitoring Organophosphorous Pesticides in the Lower San Joaquin Basin. CVRWQCB-Sacramento, California.

Acknowledgements

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Appendix A

Appendix A. Pesticide results (excluding diazinon and chlorpyrifos).

(Concentrations are in units of µg/L. ND: Not detected; J: the reported concentrations were below the quantitative limit and are considered estimates; B: possibly biased high due to high surrogate recovery in sample; Each sample was also analyzed for Bifenthrin, Azinphos methyl, l-Cyhalothrin, Cyfluthrins, Cypermethrins, Esfenvalerate, Cyanazine, Dacthal (DCPA), Methidathion and Disulfoton which were not present at detectable levels).

Site	Date	Time	EPTC (Eptam)	Simazine	Carbaryl	Metolachlor	Propargite
Merced River at River Rd.	3/10/2004	12:30	ND	(0.055 J)	ND	ND	ND
Merced River at River Rd.	3/17/2004	11:00	ND	(0.028 J)	ND	ND	ND
Merced River at River Rd.	3/25/2004	11:50	ND	(0.024 J)	ND	ND	ND
Merced River at River Rd.	3/31/2004	11:20	ND	(0.023 J)	ND	ND	ND
Merced River at River Rd.	7/9/2004	10:30	ND	ND	ND	ND	ND
Merced River at River Rd.	7/15/2004	12:30	ND	ND	ND	ND	ND
Merced River at River Rd.	7/29/2004	12:20	ND	(0.005 J)	ND	ND	ND
Merced River at River Rd.	8/4/2004	8:40	ND	ND	ND	ND	ND
Merced River at River Rd.	8/20/2004	9:40	ND	ND	ND	ND	ND
Merced River at River Rd.	8/25/2004	9:30	ND	ND	ND	ND	ND
San Joaquin River at Crows Landing	3/10/2004	12:00	ND	(0.010 J)	ND	(0.019 J)	ND
San Joaquin River at Crows Landing	3/17/2004	10:20	ND	(0.059 J)	ND	(0.010 J)	ND
San Joaquin River at Crows Landing	3/25/2004	11:20	ND	B (0.029 J)	ND	ND	ND
San Joaquin River at Crows Landing	3/31/2004	11:00	ND	(0.056 J)	ND	0.021	ND
San Joaquin River at Crows Landing	7/9/2004	10:10	(0.033 J)	ND	ND	0.44	ND
San Joaquin River at Crows Landing	7/15/2004	12:00	ND	ND	ND	0.17	ND
San Joaquin River at Crows Landing	7/29/2004	11:50	ND	(0.008 J)	ND	0.23	ND
San Joaquin River at Crows Landing	8/4/2004	9:10	ND	(0.009 J)	ND	0.13	ND
San Joaquin River at Crows Landing	8/20/2004	11:20	ND	ND	ND	0.12	ND
San Joaquin River at Crows Landing	8/25/2004	10:00	ND	ND	ND	0.069	ND
Tuolumne River at Shiloh Rd.	3/10/2004	11:00	ND	(0.011 J)	ND	ND	ND
Tuolumne River at Shiloh Rd.	3/17/2004	9:40	ND	(0.009 J)	ND	ND	ND
Tuolumne River at Shiloh Rd.	3/25/2004	10:40	ND	B (0.080 J)	ND	0.023	ND
Tuolumne River at Shiloh Rd.	3/31/2004	10:20	ND	(0.033 J)	ND	ND	ND
Tuolumne River at Shiloh Rd.	7/9/2004	9:10	ND	(0.026 J)	ND	ND	ND
Tuolumne River at Shiloh Rd.	7/15/2004	11:20	ND	(0.008 J)	ND	0.028	ND

Appendix A. Pesticide results (excluding diazinon and chlorpyrifos).

(Concentrations are in units of µg/L. ND: Not detected; J: the reported concentrations were below the quantitative limit and are considered estimates; B: possibly biased high due to high surrogate recovery in sample; Each sample was also analyzed for Bifenthrin, Azinphos methyl, l-Cyhalothrin, Cyfluthrins, Cypermethrins, Esfenvalerate, Cyanazine, Dacthal (DCPA), Methidathion and Disulfoton which were not present at detectable levels).

Tuolumne River at Shiloh Rd.	7/29/2004	11:10	ND	(0.012 J)	ND	(0.009 J)	ND
Tuolumne River at Shiloh Rd.	8/4/2004	9:50	ND	(0.007 J)	ND	(0.011 J)	ND
Tuolumne River at Shiloh Rd.	8/20/2004	12:20	ND	ND	ND	ND	ND
Tuolumne River at Shiloh Rd.	8/25/2004	10:40	ND	(0.030 J)	ND	ND	ND
San Joaquin River at Vernalis	3/10/2004	10:30	ND	(0.064 J)	ND	(0.011 J)	ND
San Joaquin River at Vernalis	3/17/2004	9:10	ND	(0.071 J)	ND	ND	ND
San Joaquin River at Vernalis	3/25/2004	10:00	ND	(0.050 J)	ND	ND	ND
San Joaquin River at Vernalis	3/31/2004	9:50	ND	(0.052 J)	(0.017 J)	(0.007 J)	ND
San Joaquin River at Vernalis	7/9/2004	8:40	ND	(0.024 J)	ND	0.17	ND
San Joaquin River at Vernalis	7/15/2004	10:30	ND	ND	ND	0.085	ND
San Joaquin River at Vernalis	7/29/2004	10:30	ND	(0.007 J)	ND	0.055	ND
San Joaquin River at Vernalis	8/4/2004	10:20	ND	(0.007 J)	ND	0.051	ND
San Joaquin River at Vernalis	8/20/2004	10:20	ND	(0.007 J)	ND	0.037	ND
San Joaquin River at Vernalis	8/25/2004	11:10	ND	(0.030 J)	ND	0.027	ND
Stanislaus River at Caswell State Park	3/10/2004	10:00	ND	(0.041 J)	ND	ND	ND
Stanislaus River at Caswell State Park	3/17/2004	8:30	ND	(0.068 J)	ND	ND	ND
Stanislaus River at Caswell State Park	3/25/2004	9:20	ND	(0.055 J)	ND	ND	ND
Stanislaus River at Caswell State Park	3/31/2004	9:10	ND	(0.042 J)	ND	ND	ND
Stanislaus River at Caswell State Park	7/9/2004	7:50	ND	ND	ND	0.058	ND
Stanislaus River at Caswell State Park	7/15/2004	9:50	ND	ND	ND	ND	ND
Stanislaus River at Caswell State Park	7/29/2004	10:00	ND	ND	(0.020 J)	ND	ND
Stanislaus River at Caswell State Park	8/4/2004	10:50	ND	(0.006 J)	ND	ND	(0.160 J)
Stanislaus River at Caswell State Park	8/20/2004	13:20	ND	ND	(0.018 J)	ND	ND
Stanislaus River at Caswell State Park	8/25/2004	11:50	ND	ND	ND	ND	ND